Minutes of the
111th Meeting
25-27 June 2002

Executive Summary

A joint meeting of the U.S. Army Corps of Engineers Committee on Tidal Hydraulics and the Committee on Channel Stabilization was held in Vicksburg, Mississippi 25-27 June 2002 at the invitation of the Program Manager of the Regional Sediment Management Research Program.

The Committees were asked to review and provide feedback on the work units of the Regional Sediment Management Research Program (RSMP). The Technical Session consisted a briefing on the Civil Works Strategic R&D, an overview on the concept of regional sediment management, and an introduction to some regional sediment management demonstration projects. An overview on the Regional Sediment Management Research Program was given followed by more detailed presentations on most of the work units in the program. A tour of the nearly completed ESTEX research facility was also conducted

In the CTH Executive Session, the committee considered the questions on the RSMP Work Unit Feedback forms and designated a sub-committee to gather and prepare the written response to the RSMP Program Managers. Also discussed was the nomination of new members to fill vacancies left by those who have retired or will retire before the next meeting.

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1. The 111th meeting of the Committee on Tidal Hydraulics (CTH) was held jointly with the Committee on Channel Stabilization on 25-27 June 2002 at the Engineer Research and Development Center (ERDC) Coastal and Hydraulics Laboratory (CHL) in Vicksburg, Mississippi. The purpose of the meeting was to review and provide feedback on the work units of the Regional Sediment Management Research Program.

2. On 25 and 26 September, the Technical Session on the Regional Sediment Management Research Program work units was held. The CTH Executive Session was held on the morning of the 27th. All sessions were held in the CHL main conference room.

3. Attendees:

Committee on Tidal Hydraulics

William H. McAnally, Chairman	ERDC, Coastal & Hydraulics Lab
Virginia R. Pankow, Executive Secretary	Institute for Water Resources
Charles B. Chesnutt, Liaison	Headquarters, USACE
Lincoln C. Blake	Charleston District
A. Jay Combe	New Orleans District
Eric E. Nelson	Seattle District
Ronald G. Vann	Norfolk District
Todd L. Walton	ERDC, Coastal & Hydraulics Lab
Charles J. Wener	New England District
Frank A. Herrmann, Jr	Consultant, Vicksburg, MS

Committee on Channel Stabilization (1)

Larry E. Banks, Chairman	Vicksburg District
Dinah McComas, Secretary	ERDC, Coastal & Hydraulics Lab
Craig Fischenich	ERDC, Environmental Lab
Thomas J. Pokrefke	ERDC, Coastal & Hydraulics Lab
Edward F. Sing	South Pacific Division
Michael F. Spoor	Huntington District

Presenters and Guests (1)

Charles Berger	ERDC, Coastal & Hydraulics Lab
David Biedenharn	ERDC, Coastal & Hydraulics Lab
Maureen Corcoran	ERDC, Geotechnical & Structures Lab

Jack Davis	ERDC, Coastal & Hydraulics Lab
Chuck Downer	ERDC, Coastal & Hydraulics Lab
Bruce Ebersole	ERDC, Coastal & Hydraulics Lab
Larry Gatto	ERDC, Cold Regions Research & Engr Lab
Ronnie Heath	ERDC, Coastal & Hydraulics Lab
Kevin Knuuti	ERDC, Coastal & Hydraulics Lab
Barry McCleave	ERDC, Information Technology Lab
Carl Miller	ERDC, Coastal & Hydraulics Lab
Renee Myers	ERDC, Information Technology Lab
Trimbak Parchure	ERDC, Coastal & Hydraulics Lab
Joan Pope	ERDC, Coastal & Hydraulics Lab
Thomas Richardson	ERDC, Coastal & Hydraulics Lab
Julie Rosati	ERDC, Coastal & Hydraulics Lab
Steven Scott	ERDC, Coastal & Hydraulics Lab
Terry Sobecki	ERDC, Environmental Lab
Burnell Thibodeaux	New Orleans District

(1) Technical sessions only

4. The minutes are divided into discussions of presentations made at the Technical Session and actions taken in the Executive Session. It is not the intent of these minutes to include all the details of the Regional Sediment Management Research Program, they are available on-line at http://chl.wes.army.mil/research/sedimentation/RSM/index_old.html or http://www.wes.army.mil/rsm/ These minutes document the highlights of the presentations and the questions, concerns, and discussions that took place during the meeting.

TECHNICAL SESSIONS

5. Dr. William H. McAnally, Chairman CTH, opened the 111th meeting of the Committee on Tidal Hydraulics at 0835 on 25 June 2002. This is an unusual meeting in that two of the four special Corps of Engineers committees are meeting jointly. The combination of committees provides a pool of subject matter experts in the areas of tidal hydraulic engineering, sedimentation, alluvial channel hydraulics and channel stabilization. The Committee Chairmen, Dr. McAnally and Mr. Banks, welcomed the members and guests and encouraged active participation in the presentations and discussions. The members of the Committees, presenters, and guests introduced themselves and the Technical Session agenda was reviewed. Each Committee member was supplied with Regional Sediment Management Research Program Feedback Forms to be completed and discussed during the CTH Executive Session.

6. Mr. Thomas Richardson, Chief CHL, gave an overview of the Civil Works R&D strategic initiatives. He discussed tactical and strategic activities and initiatives.

Strategic activities are on a large, system scale, looking at future needs, involving many customers and disciplines, and frequently result in a new way of doing business. A tactical plan or activity addresses a present need and is on the scale of a project. Tactical plans usually result in an improvement of a current business practice. The research program has typically been funded on the tactical level but an increase of funds is needed to begin the strategic initiatives. This years funding level was less than needed for tactical efforts resulting in a refocus of tactical areas and, at a slower place, the start of strategic efforts. FY 02, 03, and 04 (a., b., c.,) starts include:

a. SMART – system scale ecosystem modeling, assessment and restoration technologies

b. TOWNS – Technologies and operational innovations for urban watershed networks. This program will deal with urban channel systems, flood damage reduction and emergency operations.

c. Navigation/MTS 2000 – looks at increased commerce and the aging infrastructure.

d. Flooding and Coastal Technical Support and Infrastructure Technical Support are new support programs similar to DOTS.

7. Charles Chesnutt, CECW-EW, gave an overview and brief history of the concept of regional sediment management. He prefers to call it a systems approach to sediment management. It started in a unique fashion, rather than a typical Corps approach to address an identified need. In the early 1990's the Corps asked the National Research Council (NRC) to look at how the Corps was handling beach nourishment activities. The NRC recommended linking the management of navigation dredging with adjacent shore protection projects. However, there were constraints imposed by regulations and funding was not obtained to move forward with the systems approach. With strong Coastal Engineering Research Board (CERB) support and input, Mobile District (SAM) was able to get Congressional funding to do a regional sediment management demonstration project. This involved the coordination and cooperation of Planning, Operations, and Engineering divisions. An important lesson learned was the need to identify up front the potential problems and to be pro-active in explaining the project to the local sponsors, public, and property owners. One of the challenges of a regional plan is how best to get the supply sediment to the needed site in an efficient and economical way. Regional projects need people who are aware of past projects and their effects, skilled at current design and engineering requirements and able to look to the future to anticipate long-term impacts. SAM has been working the demonstration project for 3 years and has enough data to start to look to the future. Projects should have a finite timeline, i.e. be kept to three years, and not be allowed to go on forever.

8. Discussion: The issue of reuse of dredge material is complex because of environmental and economic reasons. Clean sand is dredged and dumped and frequently finds it way back into the channel creating the need to dredge again. Yet there are beaches needing the sand. A regional approach can solve both problems. Use a district's pilot project as a sample case study to help other districts understand

the implementation of the regional concept. In the SAM demonstration project, a GIS was built of the system with as much data as possible in a common format. This information (database and models) could reduce the cost of future feasibility studies by a significant amount. The SAM demonstration project also connects to the Chief's environmental operating principals and should be promoted.

9. Risk is also a factor. Engineers typically are not risk takers. Even thought the regional sediment management concept is not perceived as risky, it involves the coordination and cooperation of many diverse groups and agencies. Risk will come with the implementation and this is where the technical aspects of the RSM program will be valuable. The Corps' technical people generally want the tool to be perfect before it is released. By delaying a void has been created and non-technical people are making decisions that might not be correct. The Corps should listen to sponsors but still has the responsibility of validating the correctness and applicability of the approach. Simple tools are needed that will allow the engineer to give first cut answers to questions about resolving hydraulic and sediment transport issues. Field offices should be made aware of existing modeling tools which can be used to solve problems now.

10. Julie Rosati, CHL, presented information on the National Regional Sediment Management Demonstration Program. She discussed demonstration projects in Mobile, Jacksonville, Philadelphia, New York, Detroit, and Los Angeles Districts. These projects are generally looking for alternative disposal areas, sites that need sand for habitat, or storm protection. A regional monitoring program containing a good data collection program and models of water levels, circulation, waves and sediment transport are needed. A GIS can be developed and the experience shared with other districts as they develop their own database and models. Annual nation-wide workshops are to be held to disseminate information quickly. In addition to adequate funding, some other R&D needs are:

a. Regional data – what are the minimum requirements?
b. Community databases and models for all to use.
c. Regional models that link existing models to include riverine, estuarine and coastal models.
d. Operational guidance and decision support tools.

11. Among the challenges to overcome are the different funding cycles of the Corps and sponsors; the realization that the Federal Standard of the least cost alternative may not be the best solution to regional sediment management; the work of getting the involvement and cooperation of all stakeholders; and the need to have regional oversight of all projects by a team or individual. The benefits of data and information sharing, cooperation among agencies, and the optimization of funds and resources easily make the project a success.

12. Discussion: Several of the demonstration projects described seemed rather small

scale and very much like the traditional Corps project. They also seem more like local dredged material management projects. What about trying to keep the sediment in place? There is a need to quickly prove that we (the Corps) can save money and dredge/dispose wisely and then proceed to source control. Unique elements from these projects should be promoted especially if it will have a broad scale scope.

13. Jack Davis, CHL, presented a RSM R&D overview. The Regional Sediment Management Research Program (RSMP), started in FY 02, is a multi year $40 million program designed to provide the Corps of Engineers with the tools and knowledge needed to manage sediment on a regional basis in order to achieve high performance water resources projects that are economically and environmentally sustainable. The goal is to seek ways to minimize project disruption of natural sediment pathways and to mitigate natural processes that adversely affect water resource project performance or their impacts on the region. The Federal Standard requires least cost, best engineering and environmentally sound. Least cost does not necessarily violate the environmental standards but may not be the best environmental solution for the project. The RSM uses a regional perspective in making management decisions. It involves all Corps functions (Regulatory, Real Estate, Operations, Natural Resources, Planning, Engineering) and a multitude of other Federal (FEMA, NOAA, USOS, USPS, etc.), State and local agencies, partners and stakeholders. RMS activities must deal with multiple and competing interests. The program is set up around focus areas of basic processes, how-to guidance, model development/enhancement, informatics, and technology transfer. The products will be the development of a geomorphic framework, engineering solution and RMS tool sets. Whenever possible, existing systems will be used and modified for other uses. There is no need to reinvent the wheel; it is costly and time consuming.

14 Mr. Davis gave some potential RSM uses:

a. Optimization of reservoir pool regulation to minimize bank erosion.
b. Great Lakes water level damage assessment using RMS models to predict future bluff erosion.

c. The Baltimore District's Chesapeake Bay shoreline erosion study involving watershed management to address the problem of the Susquehanna pools filling with sediment. RMS tools and models might assist in the regional assessment and management of shoreline protection for decisions regarding permit applications.

15. Discussion: Concern was expressed that some Regulatory personnel may use some sediment tools (unwisely) to make decisions. There is a need to keep technical experts in the decision process. H&H needs to be involved with Regulatory in the

decision process.

16. The presentations of individual RSM work units began with Dr. Charlie Berger, CHL, discussing the work unit titled Multi-Dimensional Sediment Processes Models – Channels and Structures. The objective of the work is to produce state of the art modeling capability to a) make hydrodynamic and sediment long-term simulations of rivers, estuaries, reservoirs, and the littoral zone and b) make flow and sedimentation simulations near and in hydraulic structures. The models will include cohesive and non-cohesive sediments. The Corps is leveraging funds in that DoD is developing the non-cohesive work and the RSM is funding the cohesive sediment transport work. These multi-dimensional models will be a) modular – contain reusable parts; b) parallel – enabling faster processing; c) adaptive – uses the DoD's ADaptive Hydraulics (ADH) framework in which the hydraulic and model experts work together each concentrating on his own expertise and not having to be proficient in the other. A tetrahedral grid adaptation, in which the model will refine the grid by adding nodes and cells as needed, will be used.

17. Discussion: Questions were raised about leaving the grid adaptation feature on for both base and plan model runs and then determining if the base/plan results were due to the plan or the grid generated changes.

18. David Biedenharn, CHL, spoke on the work unit titled Spatial and Temporal Sediment Transport Processes Within a System Context. The objectives of this work are to expand the knowledge of sediment transport in river systems particularly with respect to the source and ultimate fate of sediments; to produce a conceptual geomorphic model to be used in the design phase of rehabilitation projects; and to define the scaling relationships for transport processes as they apply to local and regional transport calculations. This is a systems approach to erosion, sedimentation, and flood control. The work will develop the features useful to control source sediment and evaluate the effects on the rest of the system. Adjustments made in the upper basin might be successful in prolonging the life of the channel in the lower reaches. Understanding the relationship of wash load to bed material and short- and long-term stream response will lead to a better understanding of sediment transport. Wash load upstream may become bed material downstream. This work may help determine the optimal locations for bank stabilization efforts, thus focusing resources

to where it is most needed. The scope of this work unit does not include stabilization techniques but does evaluate the effectiveness of the technique on bank erosion. The results will feed into a simple model in another work unit.

19. Dr. Trimbak Parchure summarized the work in the Effect of Organic Contents on Properties of Fine Sediment Beds unit. The objective or the work is to provide new knowledge of cohesive sediment erosion processes and release of associated nutrients plus improved algorithms for erosion/release rate as a function of bulk density, organic content, and other easily measured parameters. The work will focus

on the cohesive materials found in lower parts of estuaries as the result of the salt water/sediment flocculation/deposition/navigation problem chain of events. These clays have electrical properties than can attract organics. The work will try to evaluate how the presence of organics in the sediment will affect bed erosion. Laboratory measurements of the rate of organic release under static and dynamic conditions will be taken. Measurements of bulk density, rate of erosion, nitrogen and phosphorus release and particle fall velocity will be made. Algorithms for settling and nutrient release will be developed. These products will feed in to other work units and all data will be maintained in a database.

20. Discussion: It was suggested that this work unit make use of some of the extensive collections of fine grained sediment samples when doing their lab tests. Further discussion indicated that the role of cations will not be addressed since the scope only involves organics.

21. Larry Gatto, CRREL, presented an overview of the work unit, Freeze-Thaw Effects on Soil, Bank Erosion and Bank Stability. The effort of this work is to develop a relationship between soil erodibility, bank-failure susceptibility, soil-moisture redistribution and soil weakening caused by the freeze-thaw cycle. Soil and bank erosion and bank mass failures induced by soil freeze-thaw cycling are major processes of sediment mobilization. One freeze thaw cycle can reduce strength by 50 percent and about 50 percent of the contiguous U.S. experiences 90 freeze-thaw cycles per year. The work will employ field and lab experiments to develop algorithms of the freeze-thaw effects on erosion and bank failure. These equations and coefficients can then be used in other models to represent the freeze-thaw effect.

22. Discussion: Caution was expressed that the freeze-thaw effect is not uniform. The riverbank facing the afternoon sun will experience more cycles and may have more damage.

23. Carl Miller, CHL, spoke of the work in the Sand Transport During High-Energy Storm Events unit. The thrust of this work is to expand the number and quality of benchmark data sets available for sand transport model development, calibration, and validation. The work will also provide improved a) parameterization of surf and swash zone sediment transport processes, b) estimators of net and gross transport, and c) information on the accuracy of storm-driven longshore transport estimators. These improvements will be integrated into multidimensional and regional-scale numerical models and will be used in assessing risk and uncertainty predictions. It was recognized that accurate measurements and comprehensive field data sets are needed for pre-storm, storm, and post-storm conditions. There are also before and after storm survey limitations in that more readings are needed to document post storm recovery. Mr. Miller described the instruments available at the Field Research Facility (FRF) in Duck, N.C. The features and uses of the Sensor Insertion System and the Data Acquisition System were described. Efforts to upgrade to new technology instrumentation to produce greater resolution for velocity and sediment concentration profiles are underway. An international swash workshop 'SWASHDUCK' is being planned for the FRF where research staff from universities

and other agencies will assist in the data gathering effort by supplying instruments and personnel.

24. Discussion: The Committee felt the dynamics of the swash zone was poorly understood and the basic research of this work unit might improve the understanding of the hydrodynamics and sediment transport of this high energy zone.

25. Ronnie Heath, CHL, discussed the purpose and activities in the Mixing and Deformation of Alluvial Bed Surfaces in Rivers work unit. This work will produce numerical algorithms, for use in existing models, to simulate the armoring and equilibrium sediment process associated with sediment deficit and surplus. Different current velocities will affect the bed characteristics (gradation and surface) which in turn affect the sediment transport. The understanding of these dynamics will provide an analytical methodology to simulate the armoring, hydraulic sorting and bed form formulation processes. This work is being coordinated with basic research done by Johns Hopkins with the goal of extending it into applied work. Bed material sampling guidelines are under review by the Federal Interagency Sediment Program.

26. Discussion: There is an effort to link the models but they may not be useable to the field unless there is proper training, support and assistance.

27. Julie Rosati, CHL, outlined the features of the Screening System for RMS. This is an existing work unit which will be transferred into the RSMP next year. The screening tools are designed to provide, a visual history of regional sediment management; a geographic database; and a set of simple tools and programs to provide general estimates (not solutions) to RMS situations. The tools include: a) Sediment Budget Analysis System; b) Regional Long Shore Transport database; c) sediment yield database; d) geographic database (topographic, hydrographic, soils, land use/land cover, and climatologic data), and e) trapping effects of reservoirs. The tools of the Screening System will allow the user to change conditions in an area of interest and explore the regional impacts on sediment, water quality, and other parameters of concern.

28. Discussion: The concept of preliminary screening tools within the Corps was supported but caution was raised concerning the skill and quality of the user and the problems that might arise if these programs are used outside the Corps. The goal of having information such as long shore transport rates available on the web is commendable. However, for these rates to be of value, there needs to be sufficient data to make the estimates. It was also suggested that the results should be accompanied by confidence limits to assist the user in evaluating the estimates. It was also suggested that this work might link to the National Shoreline Study, may fit into the future National Coastal Databank, and may be an appropriate place to house a reservoir database (if one exists).

29. Jack Davis, CHL, presented information on the Coastal Morphology-Change Models. He discussed the 'Cascade' model, which is a simulation of shoreline evolution and inlet bypassing at multiple scales. The Cascade model will compute regional longshore sand transport rates and natural bypassing at multiple coastal inlets and river mouths, while representing both regional and local trends in morphology and transport rates. Once an inlet is modeled and calibrated/verified the user can do 'what if' scenarios, such as how long it would take for a flood shoal to reform after it was removed/mined, or what the shoaling effects would be if a channel were widened. This work unit will enhance the existing model by allowing more scales, adding new boundary conditions, allowing time-varying sources and sinks, and adding moving external boundaries.

30. Discussion: This model might be useful in linking recovery events and the effects on inlet navigability. It was also questioned if the model is limited to small inlets or if it can be applied to large inlets such as the mouth of the Mississippi. Is it possible for the regional scale to get so large that the inlet size becomes insignificant?

31. Steve Scott, CHL, discussed the Inland River Basin Morphology Model. This work is designed to develop capabilities for simulation of local and basin-wide sediment transport and channel morphology changes. There will be several connected models enabling everything from a quick look to a detailed evaluation. The work on watersheds will cover the impacts of changing land use, enable a basin-wide view, and estimate sediment loads. The work on rivers and tributaries will model river reaction to flow and sediment loads coming into the model for long-term and large-scale effects. The 1D-modeling component, HEC RAS/HEC 6, will look for general channel responses. The multi dimensional modeling component will model 2D and 3D sediment transport effects in bendways with time and spatial scale considerations. These models can look at the effects of flow re-alignment, sediment transport, and at the local level, the effects of dike fields. Modeling estuaries is more complicated but the models will be designed to address the fate of fine sediments, deposition, erosion, and consolidation processes. This modeling system is being developed concurrently with the development of some of the component modes.

32. Discussion: It was felt that in order for the models to be linked, all inputs and outputs must be in a standard format. As these models are linked and feed information to each other the timing of events in each work unit should be monitored to ensure that the models are ready to receive or supply information to the next model component. The Committee was assured that each model can operate effectively and the work unit will develop the procedure to link the input into the next part of the watershed.

33. Chuck Downer, CHL, continued the presentations with information on the Watershed Scale Sediment TMDL (total maximum daily loading) Model. This is a 1D/2D physics based watershed scale model that will represent both surface and groundwater hydrologic processes. The advantage of a physics based model is that

the process is modeled thus eliminating the limitations of empirical models. The trade off for this increased capability is the greater difficulty in using the model and the need for more computational time. The model can produce continuous simulations of many events over a long period of time, and can link to a GIS to pull in many layers of data. It can be used to simulate sediment erosion, transport, settling, resuspension and show seasonality effects.

34. Discussion: When asked if there was a difference between different parts of the country, the presenter indicated the basic process does not change, the simulation is 'customized' by using the soil parameters for the study location. It was mentioned that the National Weather Service (NWS) is doing some interesting things that may be eclipsed by the NOAA Severe Storm Lab in Norman, OK. If this happens the NWS may abandon their model and go with the severe storms model. In SAW, post-Floyd work done by NWS and others, indicated the need for severe rain forecasts to be translated into what it looks like on the ground. We should coordinate with SAW and find our what has been done.

35. Kevin Knuuti, CHL, spoke of the Framework for Integrated Engineered Solutions in RSM. This work will develop a framework of selecting and evaluating solutions in sediment management and document lessons learned from Corps and non-Corps projects and activities. Some of the projects to be studied are: the Upper Mississippi-Illinois Waterways studies; the Chesapeake Bay study; Northern Gulf of Mexico RSM Demonstration Project and the Sacramento-San Joaquin study. The roles of different agencies and federal, state and local regulations will be included in the framework. The framework will identify state-of–the-art capabilities in engineered solutions and will be able to recommend future research that can benefit the program.

36. Discussion: The Committee felt the establishment of a Lessons Learned inventory was excellent but cautioned that it must be maintained and the maintenance responsibility be assigned to a group/individual. We need to bring all the valuable district lessons learned together in one repository and keep it funded. It was suggested that the CTH consider spearheading the effort to get the districts to support (with information and funds) the repository.

37. Dr. Timbak Parchure, CHL, summarized the work of Managing Local and Regional Fine-Sediment Channel Deposition. The work will look for innovative non-dredging methods to reduce or control sedimentation in navigation channels and conceive new methods for evaluation. It will establish an organized classification of shoaling problems, develop methods of evaluation, and summarize the results of previous efforts. The result of a literature search produced a list of 33 ways of

reducing shoaling in navigation channels. Also discussed were some known success stories such as the Savannah estuary sediment trap, Charleston harbor re-diversion, and the Current Deflector Wall in Hamburg, Germany. It was recognized that success is site specific and success in one area might not be applicable to other areas.

38. Discussion: The literature search will produce information on many projects but an effort must be made to verify that the project was completed and to evaluate the level of success. There is a need to find people with an interest in contributing information and lessons learned to this effort. It was suggested that retired Corps people are a valuable resource that should be tapped, perhaps by attending a workshop on this subject. C. Wicker, a former CTH member, did a lessons learned investigation by taking specific project recommendations and asking district people the solutions were implemented and their level of effectiveness. He received very good responses. This work could also result in a return on investment study. The Office of History as well as PIANC might be useful resources.

39. David Biedenharn, CHL, presented information on Regional Sediment Management in Flood Control Channels. Natural events and human activities have altered the dynamic equilibrium of stream systems and the surrounding ecosystem. This work unit will provide guidance for selecting and designing appropriate sediment management techniques that incorporate a holistic approach to physical, engineering and environmental standards. Tools like the catchment assessment and design tool and a geomorphic assessment based on sediment grain size, can greatly increase the understanding of the fluvial system. To determine the relative stability of a river reach, a simple model is run and adjusted until equilibrium is reached. This will help determine what needs to be done to the channel to get improvements. There is close coordination with the modeling work being done in other work units of the RSM program.

40. Discussion: The model appears robust and based on sound principles, it can be applied to many areas. It was suggested to use flow duration curves coupled with sediment transport rating curves. It was also observed that the experience level of the user is important. The user needs an understanding of the system. As the focus of many projects is to manage for the environment as well as navigation, flood control, recreation etc, it is important to know how the sediment management plans affect the project's level of service. The guidance provided in this work will assist in environmental restoration projects. There is a paradigm shift from managing Corps navigation projects with mitigation, to managing for the environment with a navigation channel.

41. Terry Sobecki, EL, described the activities in the work unit Measuring and Monitoring Sediment Processes at Regional and Local Scales. This work will involve identifying sediment measurement needs, and the existing and emerging technologies that best support these needs. The investigation and evaluation of the

technologies will produce recommended sensors, recording and transmission systems that have been configured into a standard measuring system. Workshops will be held to identify the information needs of the project. In addition, data gathering, data accuracy, data management, and the best methods of data presentation for decision support will be discussed. The work will focus on sediment sources and sinks, sediment properties, quality of sediment transport data, and the consolidation of Corps guidance and standards.

42. Jack Davis, CHL, introduced the subject of Informatics. The objective is to produce an informatics environment to blend data, software tools and procedures. Work will focus on the areas of database tools for data storage and mining; decision support tools for multi-level analysis; informatics tools for system wide numerical simulations; and web based framework for informatics. This work will use spatial data standards to make seamless the pass over from one model to another. The tools will be run on field personal computers using industry standard operating systems and software applications. Web-based tools will allow users to access data located in local and remote databases. The web will also allow access to decision support tools and modeling results.

43. Terry Sobecki, EL, concluded the RMS presentations with an overview of the Technology Transfer and Insertion focus area. The focus of this work is to insert the products (knowledge, models, designs, databases, decision tools) from the RSM program into standard Corps practice and to establish communication (information exchange) within the Corps and with numerous agencies, stakeholders, organizations and institutions. Activities will include the formation of a review and advisory group; product life cycle planning to support and sustain the products; the establishment of product delivery guidance process; product inventory; technical assistance; and post implementation evaluation.

44. The presentations completed, a general discussion about the program took place. It was agreed that there is a lot in the RSM program (from alluvial streams to the coastal areas) that broadly applies to the Corps. There is a definite need to get the word out with newsletters (Planning Ahead was suggested), visits to Divisions, marketing pamphlets and other promotional activities. Program managers or PI's should go to the districts to listen to their RSM needs and highlight the parts of the program that might be of assistance.

45. It was noted that RSM does not fit into the Corps' NED planning guidance. There was some discussion about the NED having limitations regarding the inability to use funds from all four accounts. A case should be made to remove this limitation. Additionally it was noted that OMB is misusing the NED process and that Congress has been known to change project plans to satisfy local interests and guarantee cost sharing. Cost sharing local sponsors frequently become problems if project costs increase. However, the projects that fly are those supported by local interests and then authorized by Congress. OMB's solution to budget reduction is to

do fewer projects. Therefore the Corps needs to produce projects for less. We need a way of making projects work together to reduce the overall cost of doing business.

46. Wetland analysis is critical as well as complex. There is great value in looking at problems of erosion where there is a great difference in pool elevations. A program like this needs to be innovative. Technical information for marsh creation is needed. The RSM program may supply just what is needed to support marsh creation decisions. Resource agency requirements of a replacement rate of 3-4 acres for every one damaged are very costly. Sediment should be included in the wetland design guidance.

47. In general the Committee expressed praise for the program, its organization and goals. The program also appears to be addressing District needs. Concern was expressed that that it might not be too easy to ramp up from a small scale (particle size) to large scale (regional) model. Periodic reevaluation will be necessary to keep on track. If the distance between the headwaters to the shore is small, like the west coast, RSM might work. However, in a long river, such as the Mississippi, you will have to start at the top of the system and work your way down. Upstream events affect downstream areas and if RSM is to be successful on the large scale you will have to start at the top. It was unclear how the models will link, especially the marriage of river and coastal models. RSM should look at the entire watershed as well as arid regions and the program might be able to supply information and tools helpful to flood damage reduction efforts. Coordination with other programs is important.

48. The need for training and continued model maintenance and user support was identified. There were concerns that non-trained engineers or others could use the models and improprely apply them to their problems. It was advised that as soon as products are beta tested, they be released to the Districts for use and user feedback. Being able to show some success is important to the program and will help in maintaining confidence and funding levels. If you can show savings as the result of the program you will be better able to get the needed support. The program is very ambitious, be very careful not to underestimate the difficulty and costs of the tasks. A challenge for programs such as SMART, TOWNS and RSM is to find the best way to package the products for the districts. When the customer and researcher work together success is easier to achieve. The Districts and Divisions need to be informed of the great work that is taking place. The program must be flexible and respond to customer needs. It also needs to look at long term climate changes to be sure the apparent problem is not a systems response to some other natural forces.

49. The Technical Sessions also included a tour of the nearly completed ESTEX facility. The large research facility will be used for research in unsteady, non-uniform flow and transport research in all hydrographical zones. ESTEX consists of a deep-water research facility (50 ft by 60 ft by 10 ft deep), and a deep research basin (60 ft by 360 ft by 4 ft deep) with a movable partition wall permitting the formation of an inset flume. The facility is capable of time-varying unidirectional or reversing flows. Tides and/or currents, including saltwater-generated density currents, can be generated separately in the flume as well as in the basin. The facility is the result of

a recommendation from an international workshop jointly sponsored by the Corps, University of California, Davis and the National Science Foundation.

This concluded the Technical sessions.